

Lunar Organic Waste Reformer, Phase I

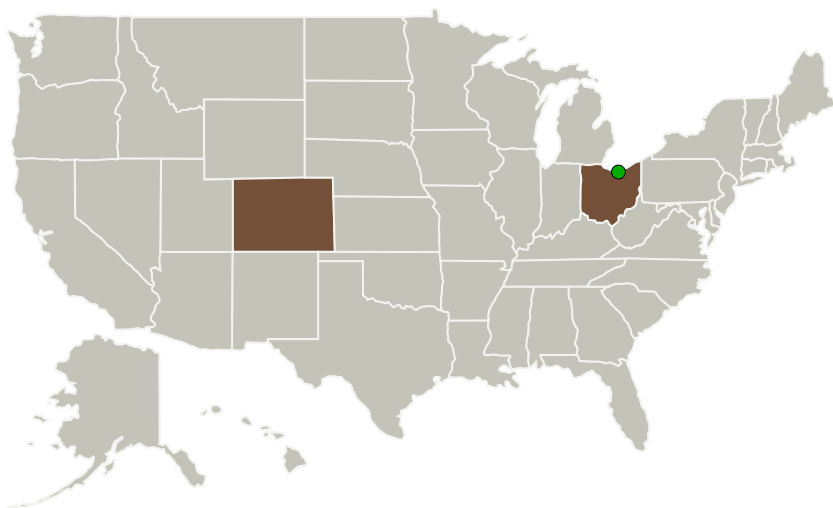
Completed Technology Project (2010 - 2010)



Project Introduction

The Lunar Organic Waste Reformer (LOWR) utilizes high temperature steam reformation to convert all plastic, paper, and human waste materials into useful gases. In the LOWR, solar thermal concentrators are used to heat steam directly to 900 C, after which the steam is injected into a reactor which is being fed with waste materials via a lock hopper. At the high temperatures, the steam will react with all organic materials to produce a gas mixture largely composed of hydrogen and carbon dioxide, with small fractions of methane and CO. After removing the remaining steam from the product stream via condensation, the gases are desulfurized and then fed through a polysulfone membrane which separates CO and CH₄ in the retentate from CO₂ and H₂ in the permeate. The retentate CO/CH₄ gas stream can be used to reduce regolith, while the CO₂/H₂ permeate stream is sent to a Reverse Water Gas Shift (RWGS) reactor which transforms the CO₂/H₂ gas into CO and H₂O. The CO can then be used for regolith reduction, while the H₂O can be used as is, or electrolyzed to make oxygen and hydrogen. With effective recycling of the steam, no consumables are lost in the process. All products are liquids or gases, making the system highly reliable and subject to automation. In the proposed Phase 1 program, Pioneer Astronautics will build on its extensive heritage with development of RWGS and regolith reduction systems developed for Lunar and Mars in-situ propellant production to build and demonstrate a LOWR unit.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Pioneer Astronautics	Lead Organization	Industry Historically Underutilized Business Zones (HUBZones)	Lakewood, Colorado
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations

Colorado	Ohio
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Project Transitions

**January 2010:** Project Start**July 2010:** Closed out**Closeout Documentation:**

- Final Summary Chart(<https://techport.nasa.gov/file/140091>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Pioneer Astronautics

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Robert M Zubrin

Co-Investigator:

Robert Zubrin

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Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX07 Exploration Destination Systems
 - └ TX07.1 In-Situ Resource Utilization
 - └ TX07.1.3 Resource Processing for Production of Mission Consumables

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System